Claims

1. A transducer comprising:

a plurality of solid layers, including a magnetically permeable loop substantially encircling an electrically conductive coil and terminating in first and second magnetically permeable layers separated by an amagnetic gap layer, said second magnetically permeable layer composed of vacuum-deposited material and oriented substantially perpendicular to said amagnetic layer.

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2. The transducer of claim 1, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer, said width being less than about four hundred nanometers.

3. The transducer of claim 1, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer, said width being not substantially greater than a distance between said magnetically permeable layers.

4. The transducer of claim 1, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer and a length measured in a direction substantially perpendicular to said amagnetic layer, with said length being at least six times greater than said width.

5. The transducer of claim 1, wherein said second magnetically permeable layer contains a refractory metal.

6. The transducer of claim 1, wherein said second magnetically permeable layer contains material having a B_s higher than that of Permalloy.

7. The transducer of claim 1, further comprising a third magnetically permeable layer disposed substantially parallel to said second magnetically permeable layer and separated from said second magnetically permeable layer with a second amagnetic layer.

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8. The transducer of claim 1, wherein said first magnetically permeable layer is substantially perpendicular to said second magnetically permeable layer.

9. The transducer of claim 1, wherein said first magnetically permeable layer is substantially parallel to said second magnetically permeable layer.

10. The transducer of claim 1, further comprising a magnetoresistive sensor layer disposed adjacent said second magnetically permeable layer and oriented substantially perpendicular to said second magnetically permeable layer.

11. The transducer of claim 1, further comprising a self-supporting substrate adjoining said transducer.

12. A transducer for an information storage system, the transducer comprising:

a plurality of solid layers, including a magnetically permeable loop substantially encircling an electrically conductive coil and terminating in first and second sputtered magnetically permeable layers separated by an amagnetic gap layer, said first magnetically permeable layer being oriented substantially perpendicular to said second magnetically permeable layer.

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13. The transducer of claim 12, wherein said second magnetically permeable layer is substantially perpendicular to said amagnetic layer.

14. The transducer of claim 12, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer, said width being less than about two hundred nanometers.

15. The transducer of claim 12, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer that is not substantially greater than a thickness of said amagnetic layer.

16. The transducer of claim 12, further comprising a third magnetically permeable layer adjoining said second magnetically permeable layer distal to said amagnetic layer, with said third magnetically permeable layer oriented substantially parallel to said amagnetic layer.

17. The transducer of claim 12, wherein said second magnetically permeable layer contains material having a B_s higher than that of Permalloy.

18. The transducer of claim 12, further comprising a third magnetically permeable layer disposed substantially parallel to said second magnetically permeable layer and separated from said second magnetically permeable layer with a second amagnetic layer.

19. The transducer of claim 12, wherein said second magnetically permeable layer contains a refractory metal.

20. The transducer of claim 12, further comprising a magnetoresistive sensor layer disposed adjacent said second magnetically permeable layer and oriented substantially perpendicular to said second magnetically permeable layer.

21. The transducer of claim 12, further comprising a self-supporting substrate adjoining said transducer.

22. The transducer of claim 12, further comprising an electroplated magnetically permeable layer disposed between said first and second sputtered magnetically permeable layers.

23. A transducer for an information storage system, the transducer comprising:

a magnetically permeable loop substantially encircling an electrically conductive coil and terminating adjacent a media-facing surface in first and second magnetically permeable layers separated by an amagnetic gap layer, wherein said second magnetically permeable layer has a growth morphology that is not substantially perpendicular to said amagnetic gap layer.

24. The transducer of claim 23, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer, said width being less than about four hundred nanometers.

25. The transducer of claim 23, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer that is not substantially greater than a thickness of said amagnetic layer.

26. The transducer of claim 23, wherein said second magnetically permeable layer has a width measured in a direction substantially parallel to said amagnetic layer and a length measured in a direction substantially perpendicular to said amagnetic layer, with said length being at least six times greater than said width.

27. The transducer of claim 23, wherein said second magnetically permeable layer consists essentially of sputtered material.

28. The transducer of claim 23, wherein said second magnetically permeable layer contains material having a B_s higher than that of Permalloy.

29. The transducer of claim 23, further comprising a third magnetically permeable layer disposed substantially parallel to said second magnetically permeable layer and separated from said second magnetically permeable layer with a second amagnetic layer.

30. The transducer of claim 23, wherein said first magnetically permeable layer is substantially perpendicular to said second magnetically permeable layer.

31. The transducer of claim 23, wherein said first magnetically permeable layer is substantially parallel to said second magnetically permeable layer.

32. The transducer of claim 23, further comprising a self-supporting substrate adjoining said transducer.

33. The transducer of claim 23, wherein said growth morphology of said second magnetically permeable layer is closer to parallel than perpendicular to said amagnetic gap layer.

34. A transducer comprising:

a body having a surface and including a magnetically permeable loop including first and second yoke layers and first and second pole-tip layers, with said first pole-tip layer disposed adjacent said first yoke layer and said second pole-tip layer disposed adjacent said second yoke layer, said loop substantially encircling an electrically conductive coil and terminating adjacent said surface in said pole-tip layers, said pole-tip layers being separated by an amagnetic gap layer, with said second pole-tip layer having a submicron width and being oriented substantially perpendicular to said amagnetic layer, and said second yoke layer containing a different material than said second pole-tip layer.

35. The transducer of claim 34, wherein said pole-tip layers and said yoke layers terminate substantially in a plane adjacent said surface.

36. The transducer of claim 34, wherein said second yoke layer terminates further from said surface than said second pole-tip layer.

37. The transducer of claim 34, wherein said first and second yoke layers terminate further from said surface than said first and second pole-tip layers.

38. The transducer of claim 34, wherein said second pole-tip layer has a first edge disposed adjacent said surface and a second edge disposed distal to said surface, and said second yoke layer adjoins said second pole-tip layer adjacent said second edge.

39. The transducer of claim 34, wherein said second pole-tip layer has a first edge disposed adjacent said amagnetic layer and a second edge disposed distal to said amagnetic layer, and said second yoke layer adjoins said second pole-tip layer adjacent said second edge.

40. The transducer of claim 34, wherein said second yoke layer and said second pole-tip layer ~~are~~ substantially coplanar.

41. The transducer of claim 34, wherein said second yoke layer overlaps a part of said second pole-tip layer.

42. The transducer of claim 34, wherein said second yoke layer has a first section oriented substantially parallel to a plane a second section that is not oriented parallel to said disposed adjacent said second pole-tip layer.

43. The transducer of claim 34, wherein said surface has a first portion that projects relative to a second portion, with said second pole-tip layer terminating adjacent said first portion and said second yoke layer terminating adjacent said second portion.

44. The transducer of claim 34, wherein said surface has a first portion that projects relative to a second portion, with said first pole-tip layer terminating adjacent said first portion and said first yoke layer terminating adjacent said second portion.

45. The transducer of claim 34, wherein said surface has a first portion that projects relative to a second portion, with said first and second pole-tip layers terminating adjacent said first portion and said first and second yoke layers terminating adjacent said second portion.

46. A transducer comprising:

a magnetically permeable loop encircling an electrically conductive coil and terminating adjacent said media in a magnetically permeable pole-tip, said pole-tip being formed on a wafer substrate along with more than five-hundred other pole-tips to have a width that is less than four hundred nanometers.

47. An information storage system comprising:

a moving media,

a transducer disposed adjacent said moving media, said transducer containing a plurality of layers deposited on a wafer substrate, said layers including a magnetically permeable loop substantially encircling an electrically conductive coil and terminating adjacent said media in a first magnetically permeable pole-tip layer and a second magnetically permeable pole-tip layer, with an amagnetic layer disposed between said pole-tip layers,

wherein a portion of said media adjacent to said transducer travels in a direction, and said second magnetically permeable layer is oriented substantially parallel to said direction.

48. The system of claim 47, wherein said second magnetically permeable layer is substantially perpendicular to said amagnetic layer.

49. The system of claim 47, wherein said second magnetically permeable layer has a width measured along said direction that is less than about three hundred nanometers.

50. The system of claim 47, wherein said second magnetically permeable layer contains a refractory metal.

51. The system of claim 47, wherein said second magnetically permeable layer contains material having a B_s higher than that of Permalloy.

52. The system of claim 47, wherein said second magnetically permeable layer consists essentially of sputtered material.

53. The system of claim 47, further comprising a magnetoresistive sensor layer disposed adjacent said second magnetically permeable layer and oriented substantially perpendicular to said second magnetically permeable layer.

54. The system of claim 47, wherein said media has an easy axis of magnetization oriented substantially along said direction.

55. The system of claim 47, wherein said media has an easy axis of magnetization oriented substantially perpendicular to said direction.

56. A method for forming a microscopic transducer, the method comprising:

forming a magnetically permeable first pole-tip,

forming a submicron amagnetic layer over said first pole-tip, and

forming a magnetically permeable second pole-tip over said amagnetic layer, including depositing a magnetically permeable material on a surface oriented transverse to said amagnetic layer.

57. The method of claim 56, wherein forming said magnetically permeable second pole-tip further comprises:

making a magnetically permeable layer having a first portion oriented along said surface and having a second portion oriented transverse to said surface, and

removing said second portion.

58. The method of claim 57, wherein removing said second portion includes impinging a beam of ions upon said layer.

59. The method of claim 56, wherein depositing said magnetically permeable material includes sputtering said material onto said surface.

60. The method of claim 56, further comprising forming a coil layer for said transducer, after said forming said magnetically permeable second pole-tip.

61. The method of claim 56, further comprising forming a coil layer for said transducer, before forming said magnetically permeable second pole-tip.

62. The method of claim 56, further comprising forming a yoke layer adjoining said magnetically permeable second pole-tip, after forming said magnetically permeable second pole-tip.

63. The method of claim 56, further comprising:

forming a magnetically permeable yoke layer before forming said magnetically permeable second pole-tip, and

joining said magnetically permeable second pole-tip to said yoke layer.

64. The method of claim 56, further comprising forming a base having an edge disposed atop said amagnetic layer and aligned with said direction, prior to creating said magnetically permeable layer.

65. The method of claim 64, further comprising removing said base, after creating said magnetically permeable layer.

66. The method of claim 64, further comprising planarizing said base and said magnetically permeable layer.

67. A method for forming a transducer, the method comprising:

forming a magnetically permeable first pole-tip,

forming a submicron amagnetic layer over said first pole-tip,

forming a base over said amagnetic layer, including forming an edge of said base bordering a covered portion of said amagnetic layer and an exposed portion of said amagnetic layer,

forming a magnetically permeable layer on said base, said edge, and said exposed portion of said amagnetic layer,

removing material preferentially from said magnetically permeable layer, including exposing part of said base and said amagnetic layer and leaving magnetically permeable material adjoining said edge.

68. The method of claim 67, further comprising removing said base from said magnetically permeable material adjoining said edge.

69. The method of claim 67, further comprising planarizing said base and said magnetically permeable layer.

70. The method of claim 67, wherein forming said magnetically permeable material includes sputtering said material onto said base, said edge, and said exposed portion of said amagnetic layer.

71. The method of claim 67, wherein removing said material preferentially from said magnetically permeable layer includes impinging a beam of ions upon said layer.

72. The method of claim 67, further comprising forming a coil layer for said transducer, after forming said magnetically permeable layer.

73. The method of claim 67, further comprising forming a coil layer for said transducer, before forming said magnetically permeable layer.

74. The method of claim 67, further comprising forming a yoke layer adjoining said magnetically permeable second pole-tip, after forming said magnetically permeable layer.

75. The method of claim 67, further comprising:

forming a magnetically permeable yoke before forming said magnetically permeable layer, wherein forming said magnetically permeable layer includes joining said magnetically permeable layer to said yoke.

76. A method for forming a pole-tip for an inductive transducer, the method comprising:

forming a body with a surface having first and second faces,

depositing a layer of magnetically permeable material on said faces,

impinging a beam of particles on said layer in a direction substantially aligned with said second face and transverse to said first face, thereby removing said layer from said first face without removing all of said layer from said second face.

77. The method of claim 76, wherein depositing said layer of magnetically permeable material includes sputtering magnetic molecules on said faces.

78. The method of claim 76, wherein impinging said beam of particles includes ion beam etching.

79. The method of claim 76, wherein depositing said layer of magnetically permeable material includes directing a plurality of magnetically permeable particles toward said body in a direction transverse to said second face.

80. The method of claim 76, further comprising means for forming a pole-tip for said transducer

81. A method for forming a transducer, the method comprising:

forming a magnetically permeable first pole-tip,

forming a submicron amagnetic layer atop said first pole-tip,

forming a magnetically permeable second pole-tip, including means for defining said second pole-tip to have a length measured in a direction perpendicular to said amagnetic layer that is at least six times greater than a width measured in a direction parallel to said amagnetic layer.

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